VISIONIAS
INSPIRING INNOVATION

QUICK REVISION MODULE (UPSC PRELIMS 2022) GEOGRAPHY

DISTRIBUTION OF KEY NATURAL RESOURCES

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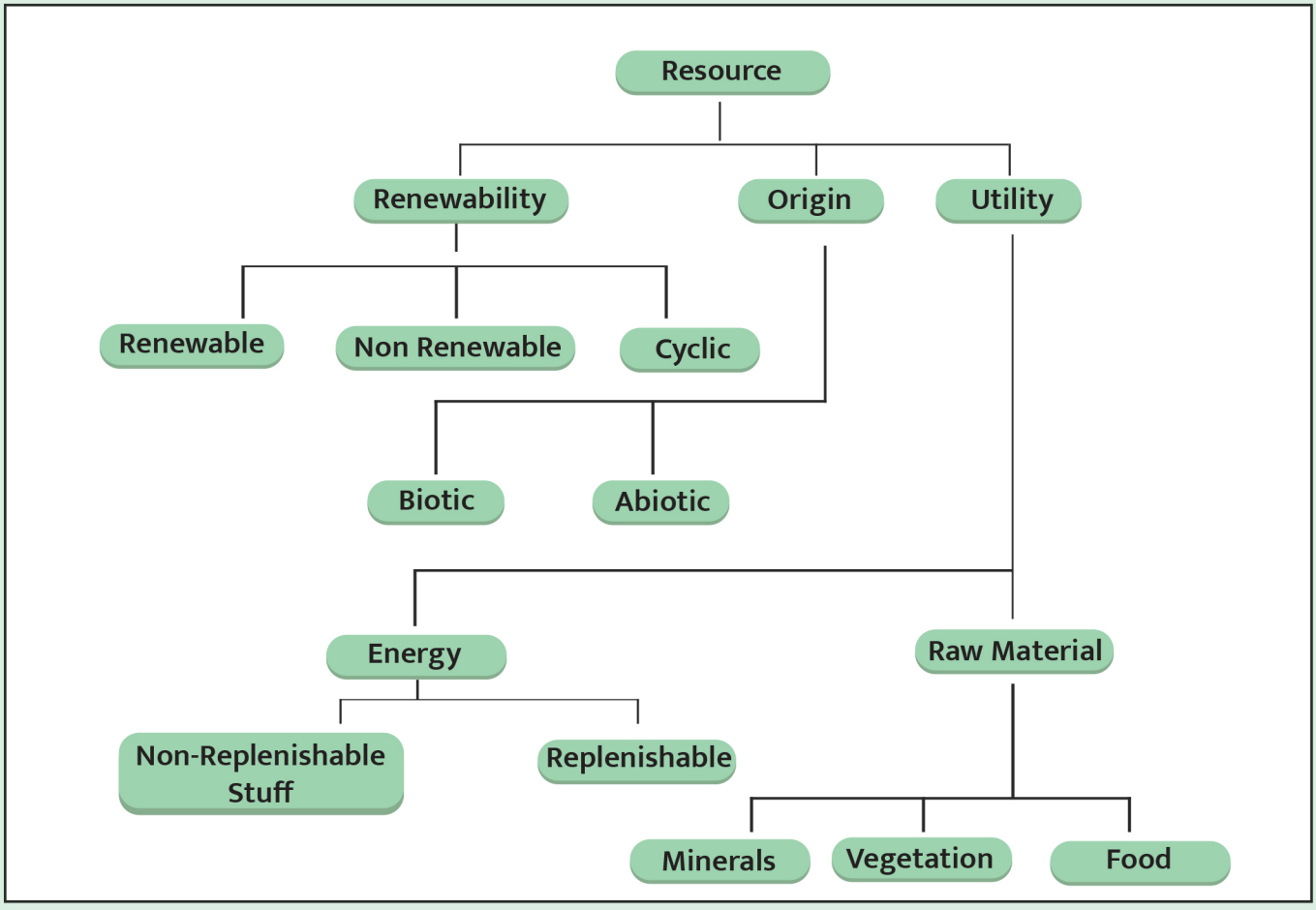
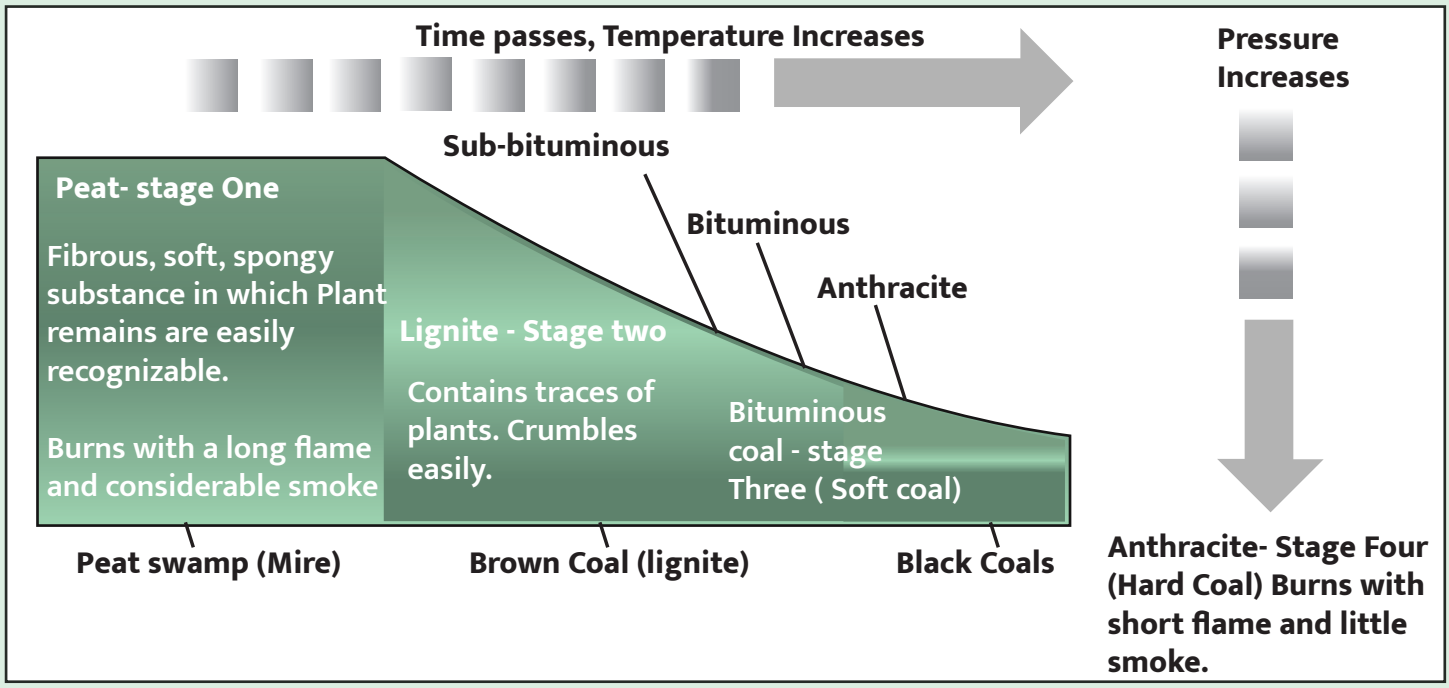
CLASSIFICATION OF RESOURCES

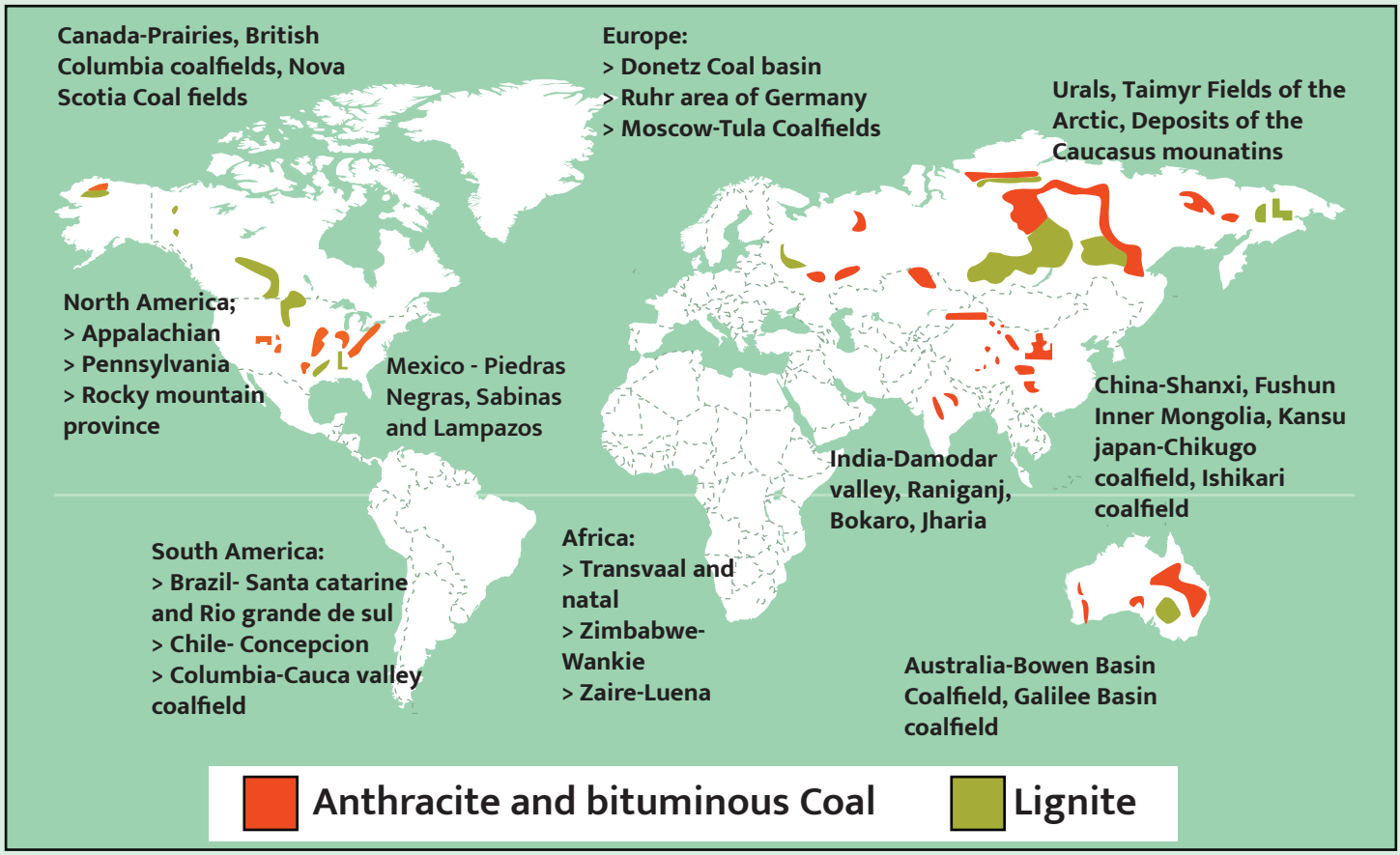


ENERGY RESOURCES

Coal



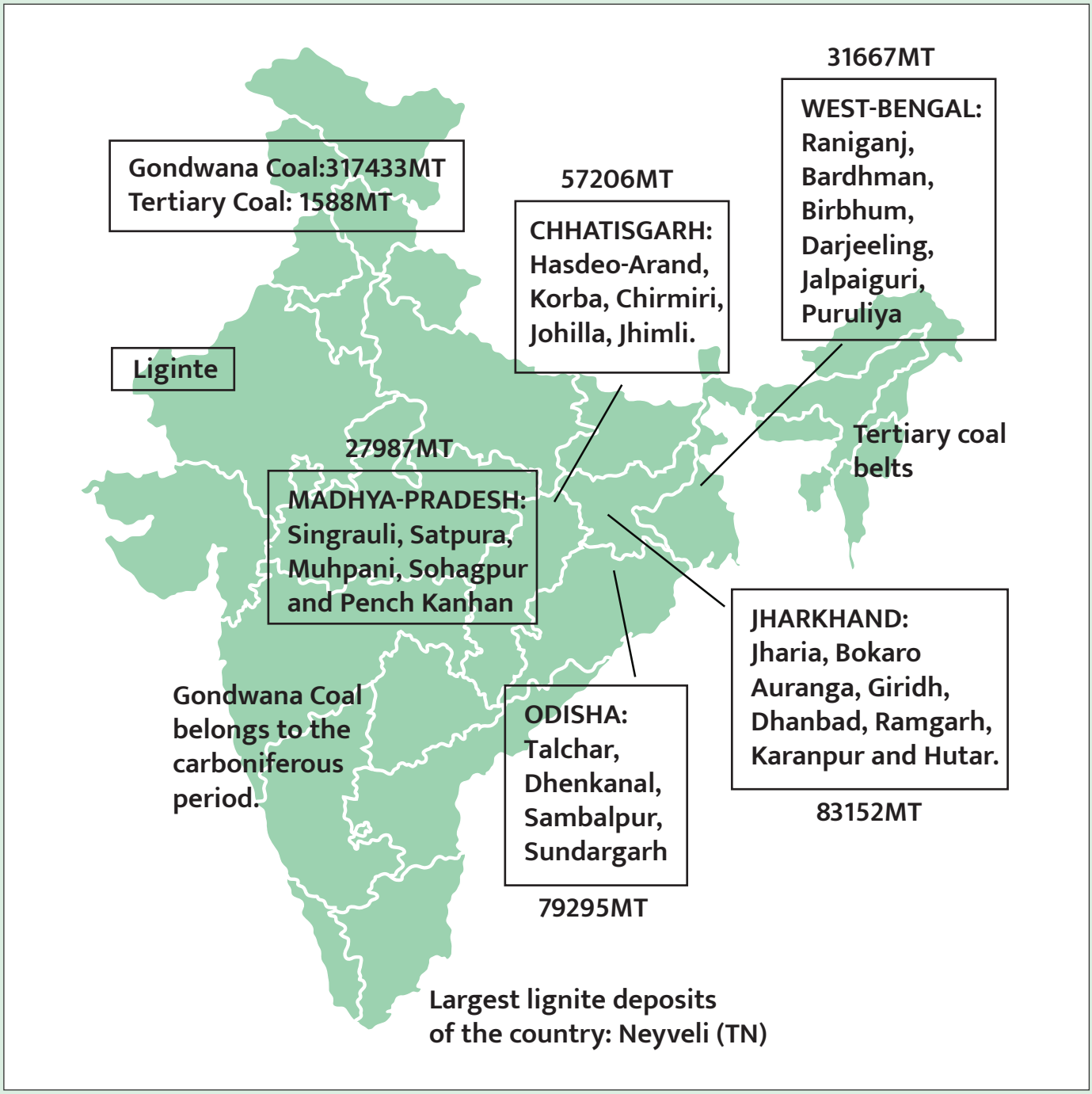
Major Coal Deposits of the World



Coal in India:

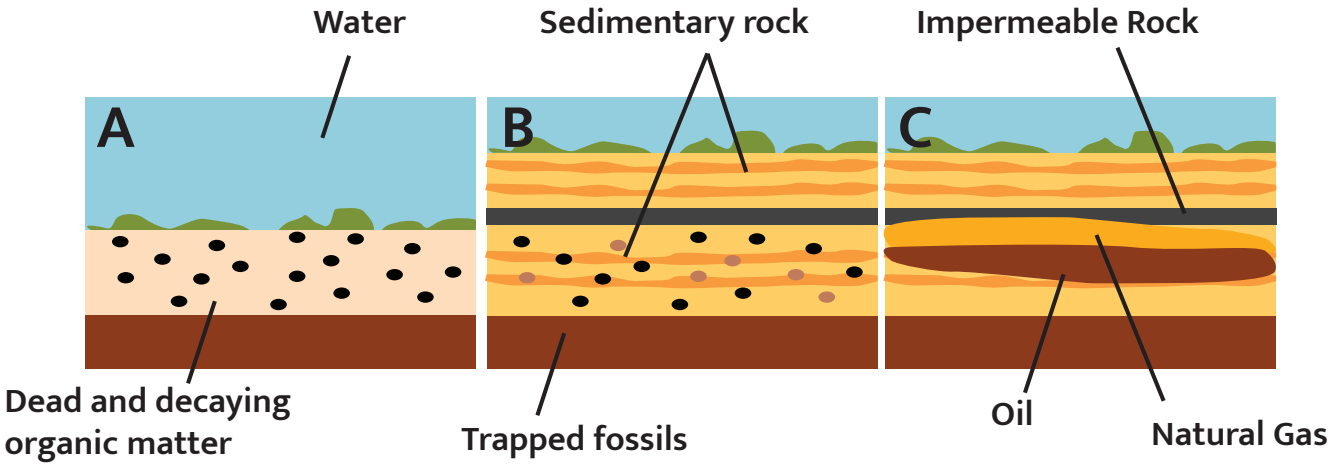
Gondwana coal	Carboniferous period	Damodar, Mahanadi, Godavari, and Narmada valleys. **Jharguda** coal mine (Chhattisgarh) is the thickest coal seam.
Tertiary coal	Tertiary era	Tamil Nadu, Gujarat, Rajasthan, Assam, Arunachal Pradesh and West Bengal.

Major Coal-fields of India



Petroleum:

Process of formation of Oil and Natural Gas:



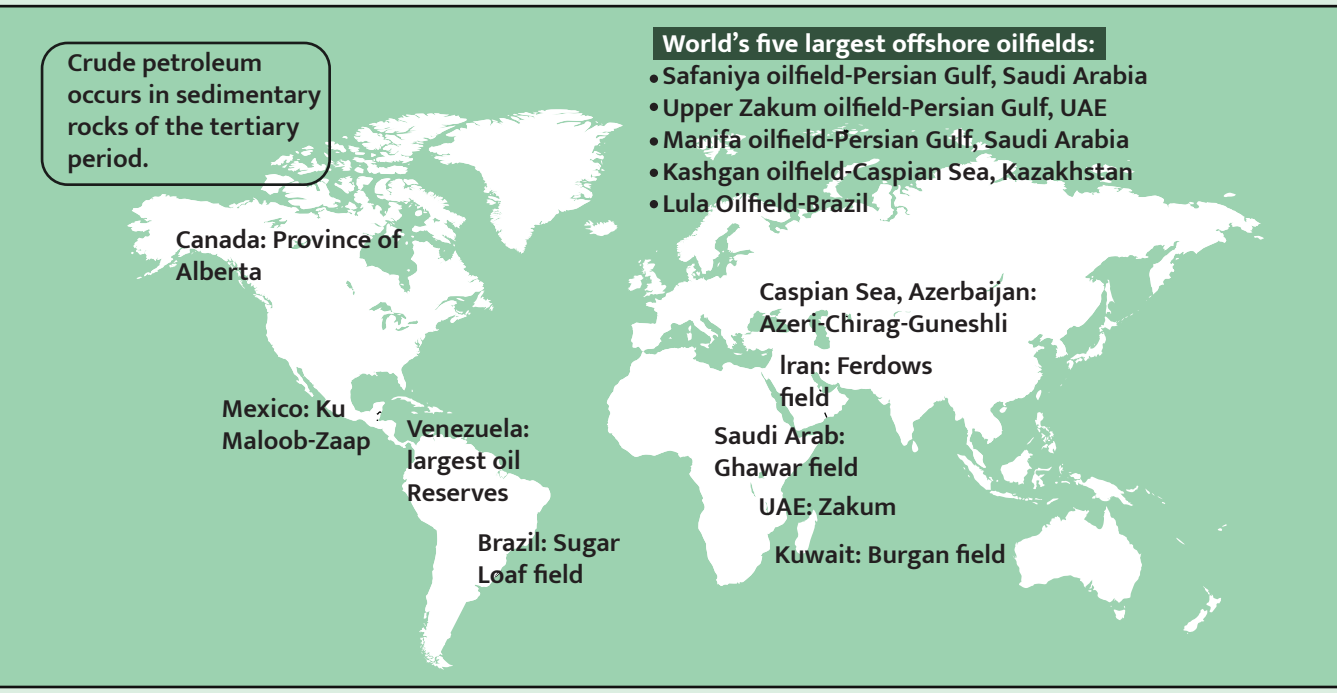
Sweet Crude

- Requires less energy to be extracted and once extracted, yields higher quality gasoline.
- Iraq is one of the leading producers of sweet crude.
- Appalachian Basin, the North Sea of Europe, North Africa, Australia, etc.

Sour Crude

- A high level of impurities, mainly sulfur.
- Venezuela is a leading producer of sour crude oil.
- Gulf of Mexico, South America, and canada, etc.

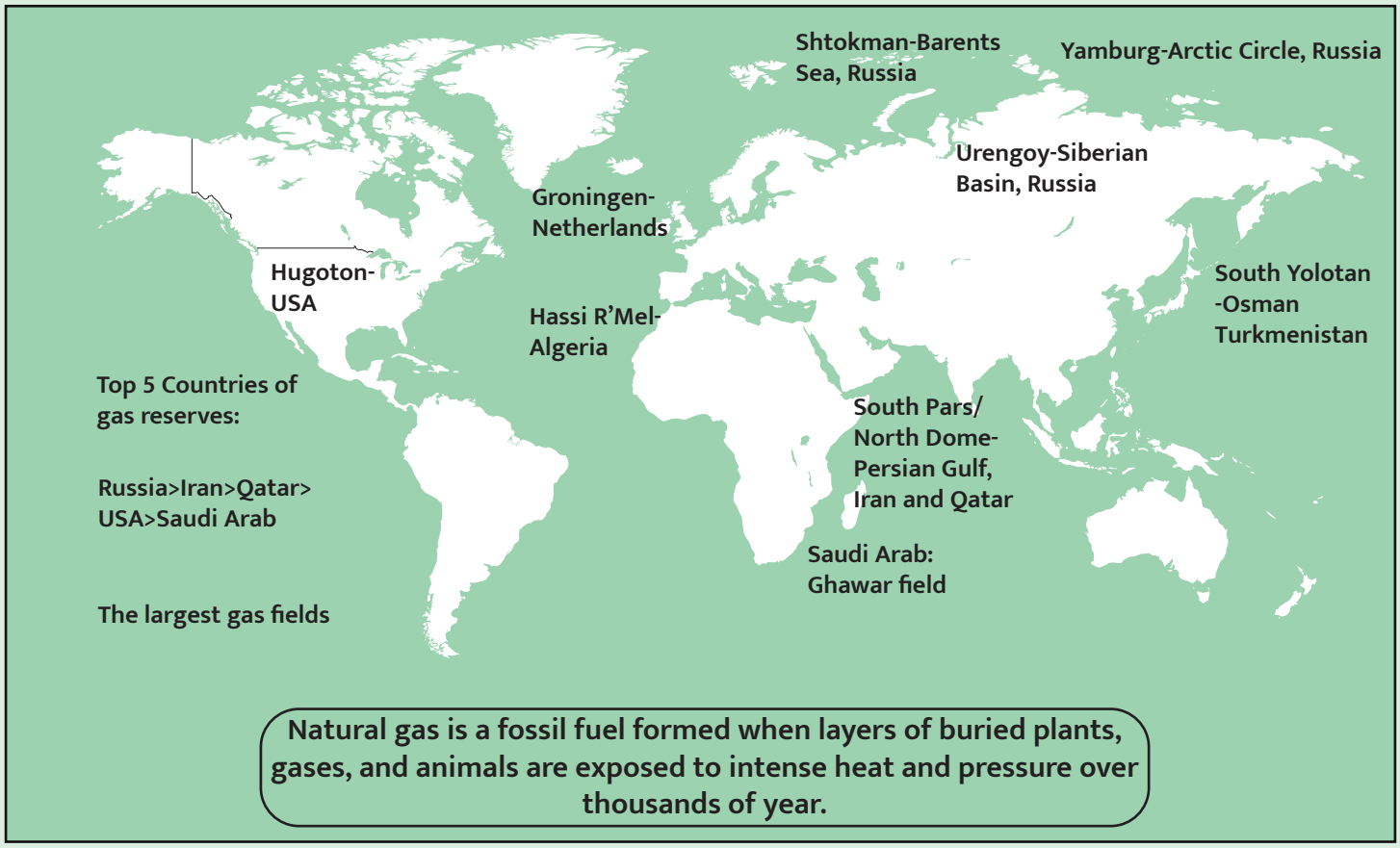
Major oil fields of the world



Natural Gas:

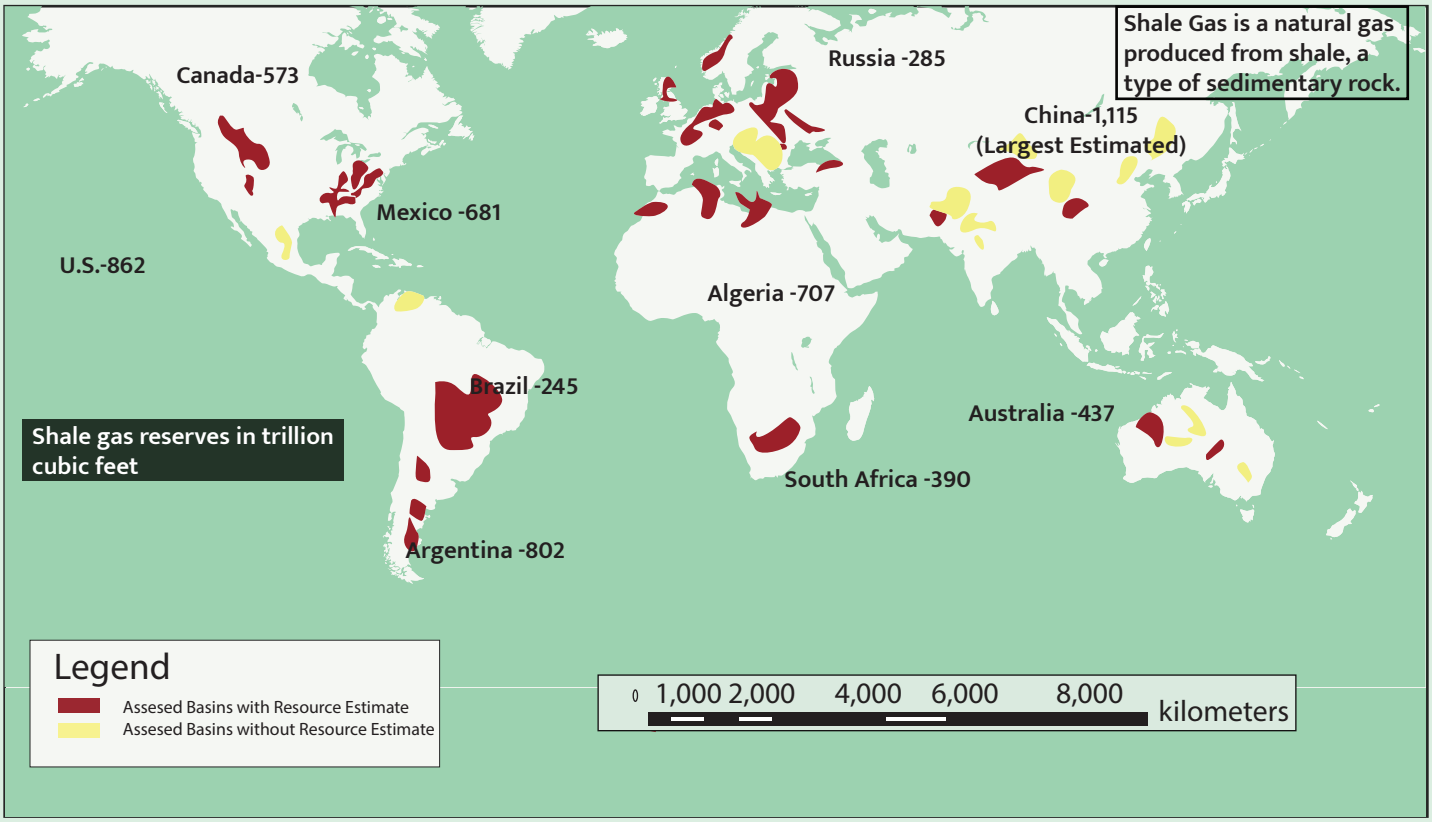
Unconventional sources of Natural gas

- **Shale gas**
  > Shale gas is a natural gas produced from shale, a type of sedimentary rock.
- **Coalbed methane (CBM)**
  > CBM is Generated by the conversion of plant material to coal through burial and heating. A significant volume of the Methane gas remains trapped within the coal itself.
- **Methane hydrates**
  > Methane Hydrate is a cage-like lattice of ice inside of which are trapped molecules of methane, as the chief constituent of natural gas. Found in sea-bed that forms at low temperatures and high pressure.

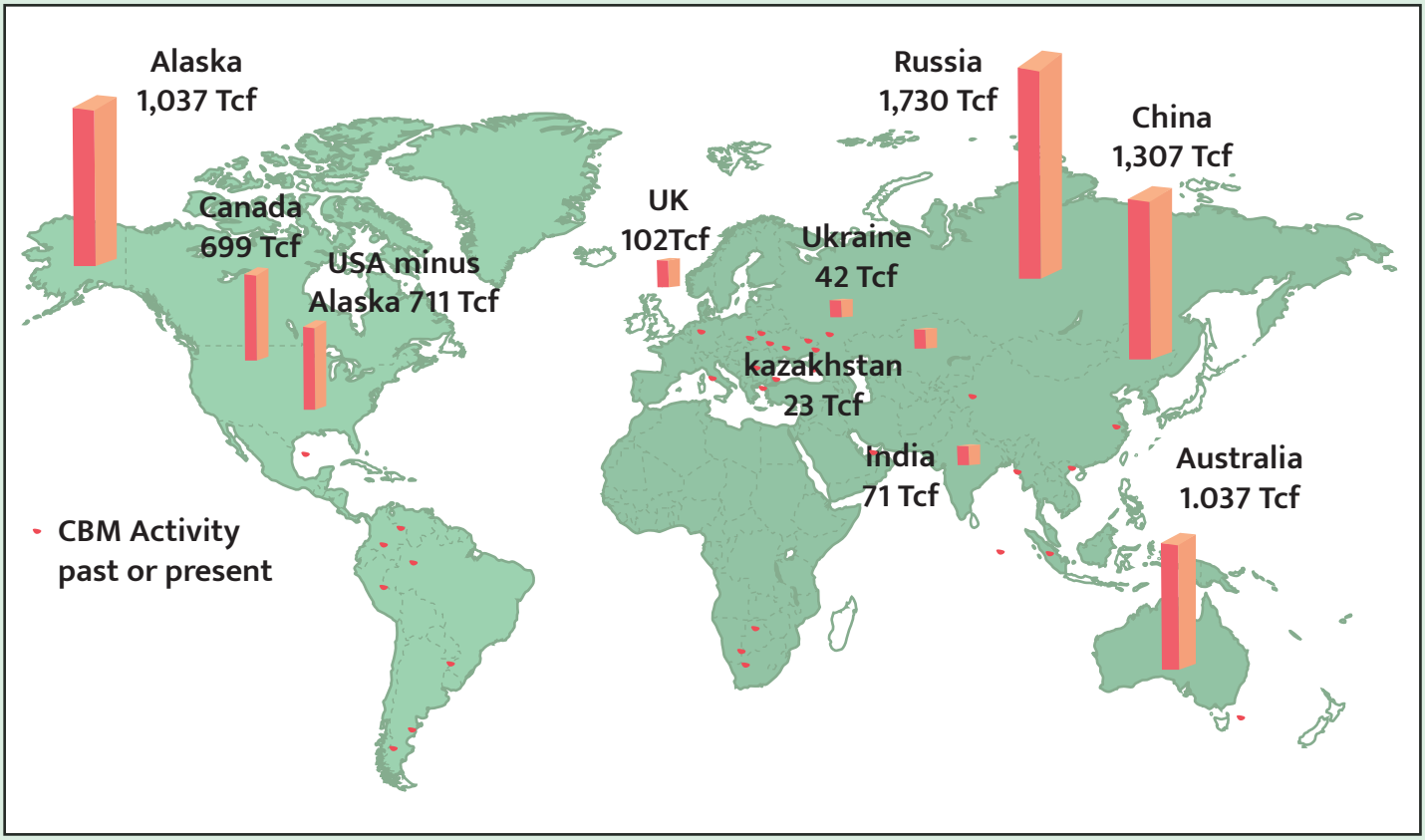


Natural gas is a fossil fuel formed when layers of buried plants, gases, and animals are exposed to intense heat and pressure over thousands of year.

Shale-Gas :



Coalbed Methane (CBM)



Statewise Estimated Reserves of Crude Oil and Natural Gas in India as on 31.03.2017 and 31.03.2018

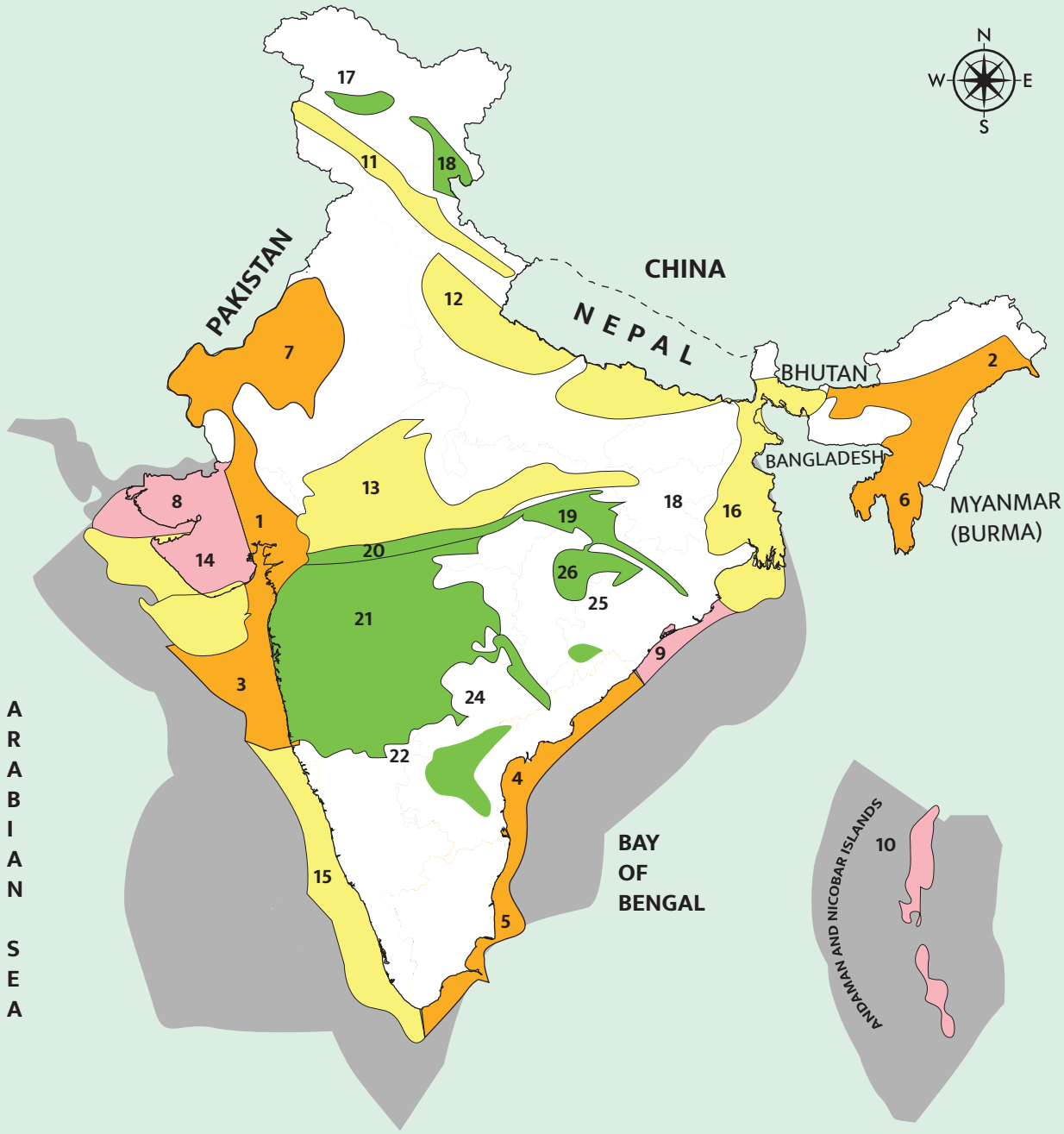
States/UTs/Region	Crude Petroleum (million tonnes)				Natural Gas (billion cubic metres)			
	31.03.2017		31.03.2018		31.03.2017		31.03.2018	
	Estimated Reserves	Distribution (%)	Estimated Reserves	Distribution (%)	Estimated Reserves	Distribution (%)	Estimated Reserves	Distribution (%)
Arunachal Pradesh	1.52	0.25	1.74	0.29	0.72	0.06	1.26	0.09
Andhra Pradesh	8.15	1.35	7.94	1.34	48.31	3.75	59.89	4.47
Assam	159.95	26.48	160.34	26.97	158.51	12.30	161.65	12.07
Coal Bed Methane (CBM)	0.00	0.00	0.00	0.00	106.67	8.27	105.94	7.91
Eastern Offshore	40.67	6.73	40.42	6.80	507.76	39.37	510.83	38.13
Gujarat	118.61	19.63	118.20	19.88	62.28	4.83	58.23	4.35
Nagaland	2.38	0.39	2.38	0.40	0.09	0.01	0.09	0.01
Rajasthan	24.55	4.06	17.99	3.03	34.86	2.70	54.85	4.09
Tamil Nadu	9.00	1.49	9.16	1.54	31.98	2.48	39.11	2.92
Tripura	0.07	0.01	0.07	0.01	36.10	2.80	35.20	2.63
Western Offshore	239.20	39.60	236.25	39.74	302.35	23.44	312.52	23.33
Total	604.10	100.00	594.49	100.00	1289.70	100.00	1339.57	100.00

* CBM: Coal Bed Methane (Jharkhand, West Bengal and M.P.)

Strategic Petroleum reserves: To ensure energy security.

- The construction of the Strategic Crude Oil Storage facilities is being managed by Indian Strategic Petroleum Reserves Limited (ISPRL), a Special Purpose Vehicle, which is a wholly owned subsidiary of Oil Industry Development Board (OIDB) under the Ministry of Petroleum & Natural Gas.
- Presently operating.
  - > Visakhapatnam (Andhra Pradesh), Mangaluru (Karnataka), and Padur (Karnataka)
- Planned.
  - > Chandikhol (Odisha) and Padur (Karnataka)

India's Hydrocarbon Potential



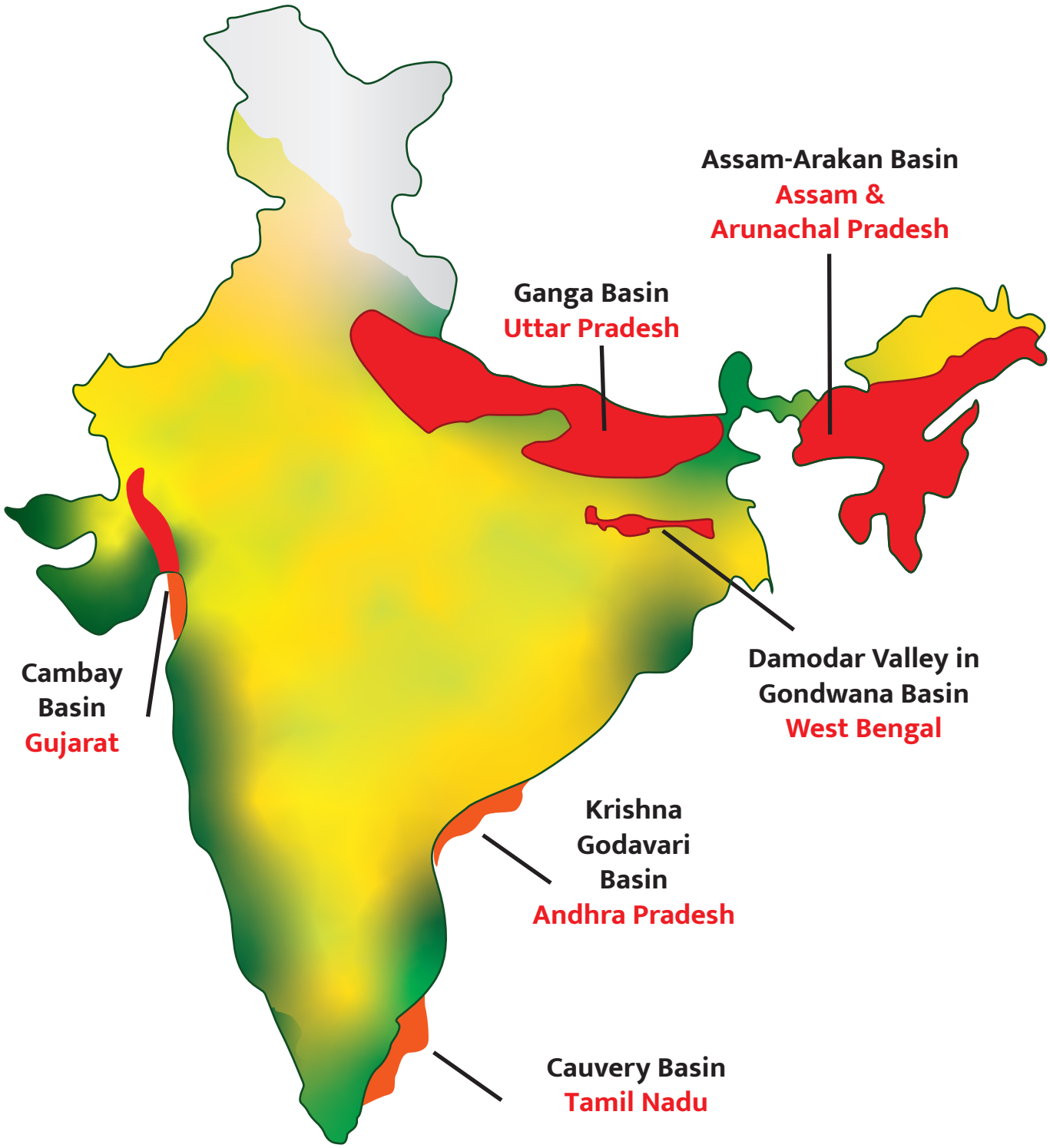
3.14 Million Sq. Km. of area Spread across 26 sedimentary

Lates study indicates hydrocarbon prognosticated resources of 41,872 MMTOE for 26 sedimentary basins and offshore areas

Discoverred HC resources: 12,076 MMTOE Undiscovered HC resources esimate 29,796 MMTOE

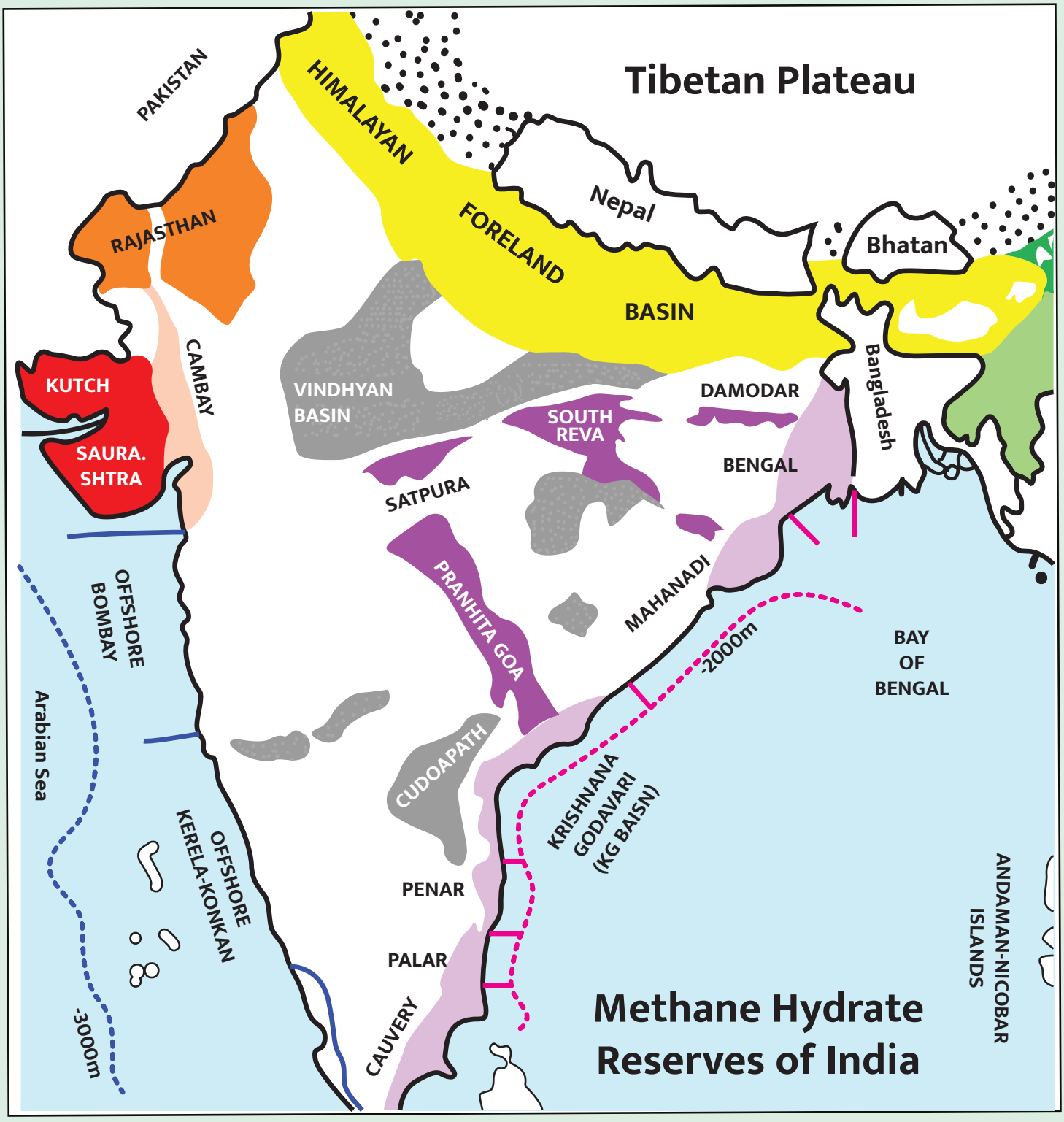
About 49.1% Increase in HC Resources estimates as compared to the earlier study undertaken in 1995-96

Prospective basins for phase 1 shale oil and gas exploration



Six onshore basins — Cambay, Krishna-Godavari, Cauvery, Assam- Arakan, Ganga and Gondwana/ Damodar.

Methane Hydrate Reserves



Kerala-Konkan basin, the Krishna- Godavari basin, the Mahanadi basin and the seas off the Andaman Islands.

Methane Hydrate Reserves

CBM in India

S.No	State	Reserves of CBM in (BCM)	Reserves of CBM in (TCF)
1	Jharkhand	722.08	25.5
2	Rajasthan	359.62	12.7
3	Gujarat	351.13	12.4
4	Odisha	243.52	8.6
5	Chhattisgarh	240.69	8.5
6	Madhya Pradesh	218.04	7.7
7	West Bengal	218.04	7.7
8	Tamil Nadu	104.77	3.7
9	Telangana	99.11	3.5
10	Andhra Pradesh	99.11	3.5
11	Maharashtra	33.98	1.2
12	North East	8.5	0.3

Major Oil/Gas fields

State	Major Oil/Gas Field
Rajasthan	Barmer oil fields
Assam	Digboi, Naharkatiya and Moran
Gujarat	Ankaleshwar, Kalol, Mehsana, Nawagam, Kosamba

Some Quick Facts and Trends:

Minerals used for the generation of nuclear energy are uranium and thorium.

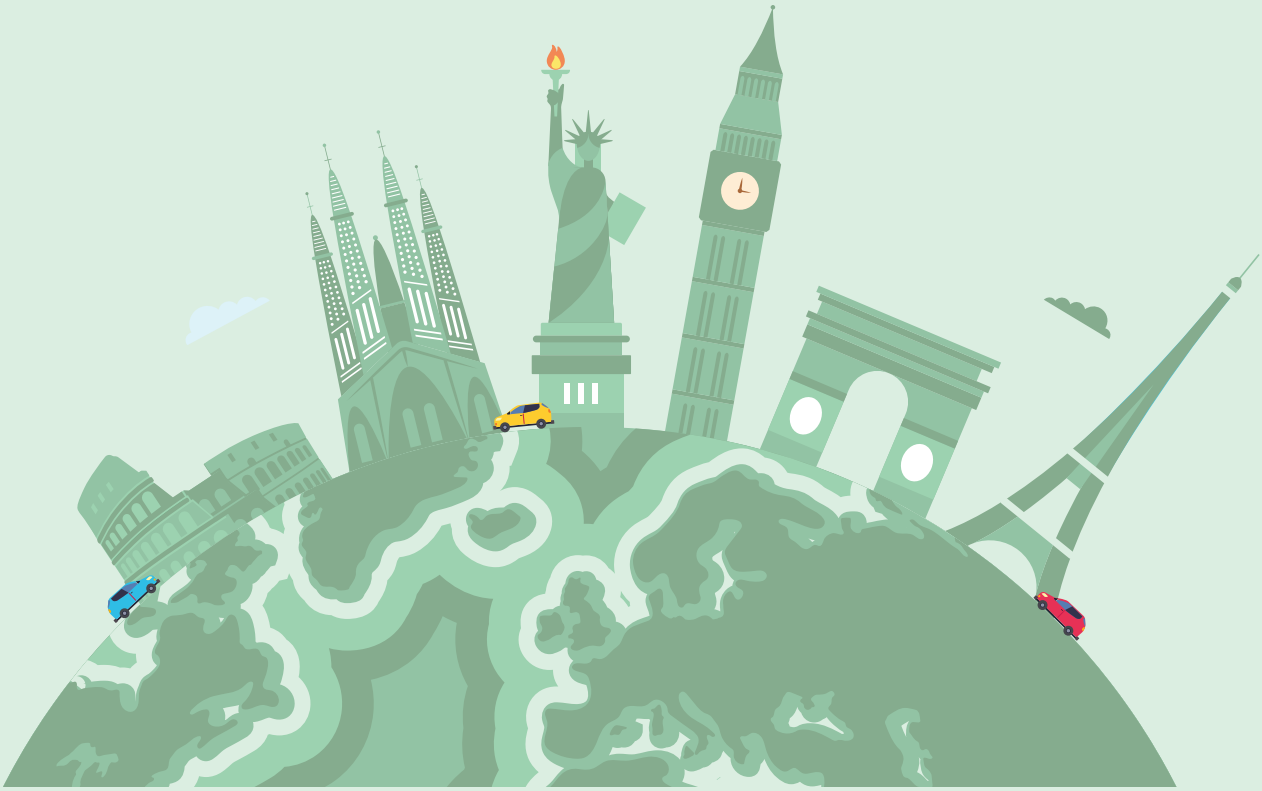
Over two-thirds of the world's production of uranium from mines is from Kazakhstan, Canada and Australia. Kazakhstan produces the largest share of uranium from mines (42% of world supply from mines in 2019), followed by Canada (13%) and Australia (12%).

An increasing amount of uranium, now over 50%, is produced by in situ leaching.

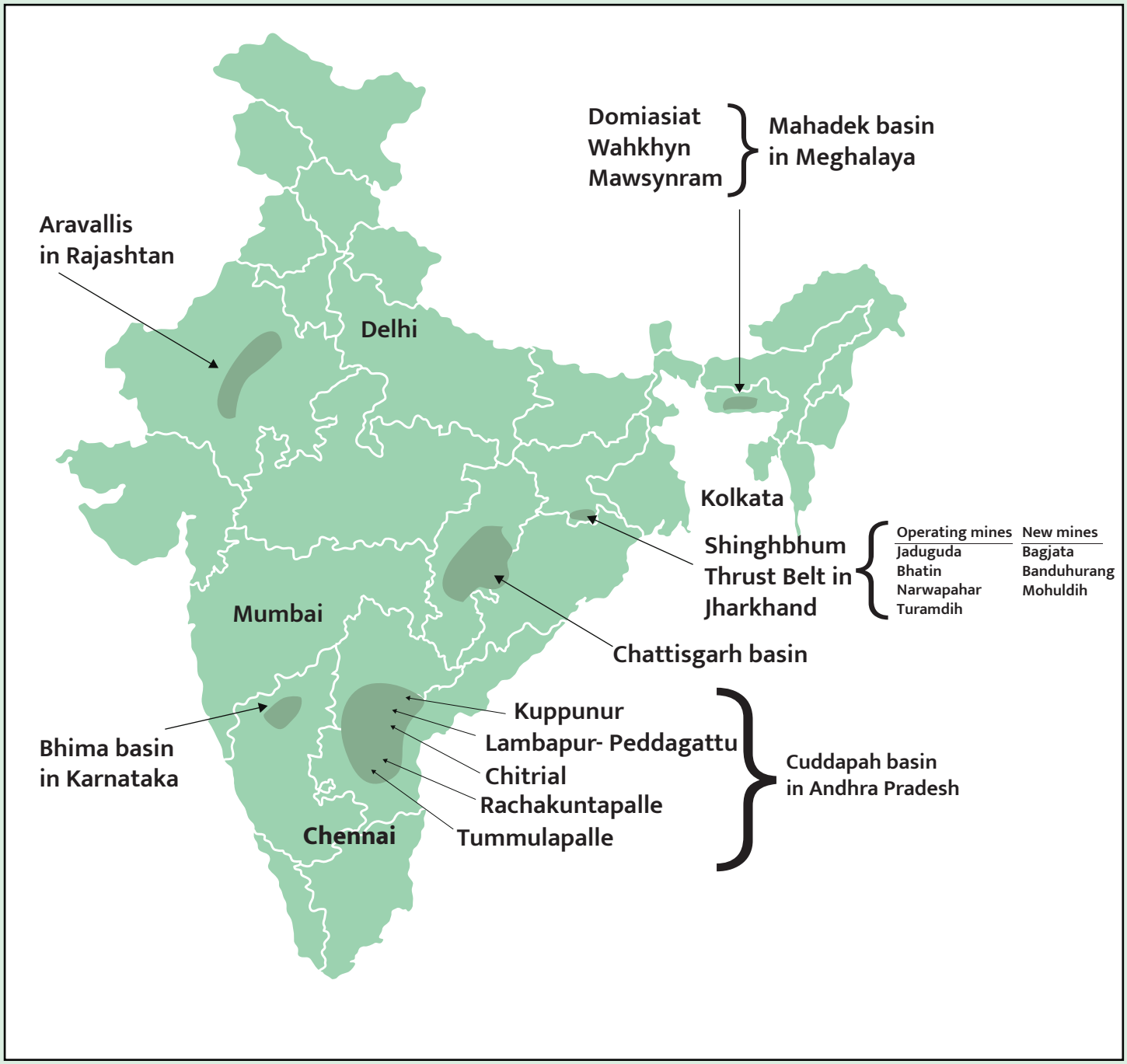
Recycled uranium and plutonium is another source for Uranium fuel. Re-enrichment of depleted uranium (DU, enrichment tails) is another secondary source.

Uranium resources by country in 2019

	Tonnes U	Percentage of world
Australia	1,692,700	28%
Kazakhstan	906,800	15%
Canada	564,900	9%
Russia	486,000	8%
Namibia	448,300	7%
South Africa	320,900	5%
Brazil	276,800	5%



Major uranium provinces of India



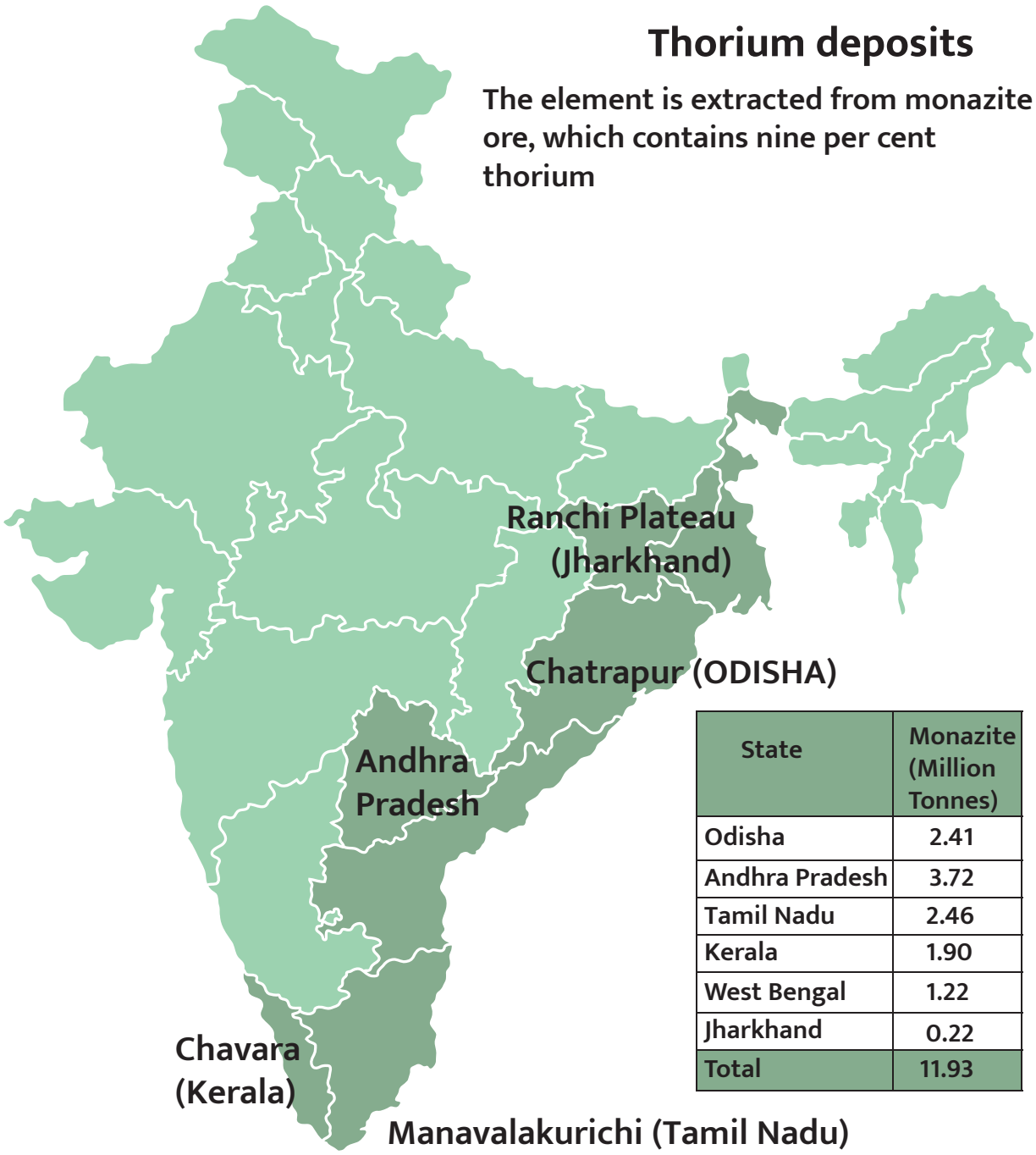
Thorium as a nuclear fuel

Thorium is about 3.5 times more common than uranium in the Earth's crust. IAEA and USGS figures: Largest reserves in the world are found in India which has around 25% of the world reserves. US and Australia's reserves among the other major reserves.

World's richest monazite deposits occur in Palakkad and Kollam districts of Kerala, near Vishakhapatnam in Andhra Pradesh and Mahanadi river delta in Odisha.

Thorium deposits

The element is extracted from monazite ore, which contains nine per cent thorium



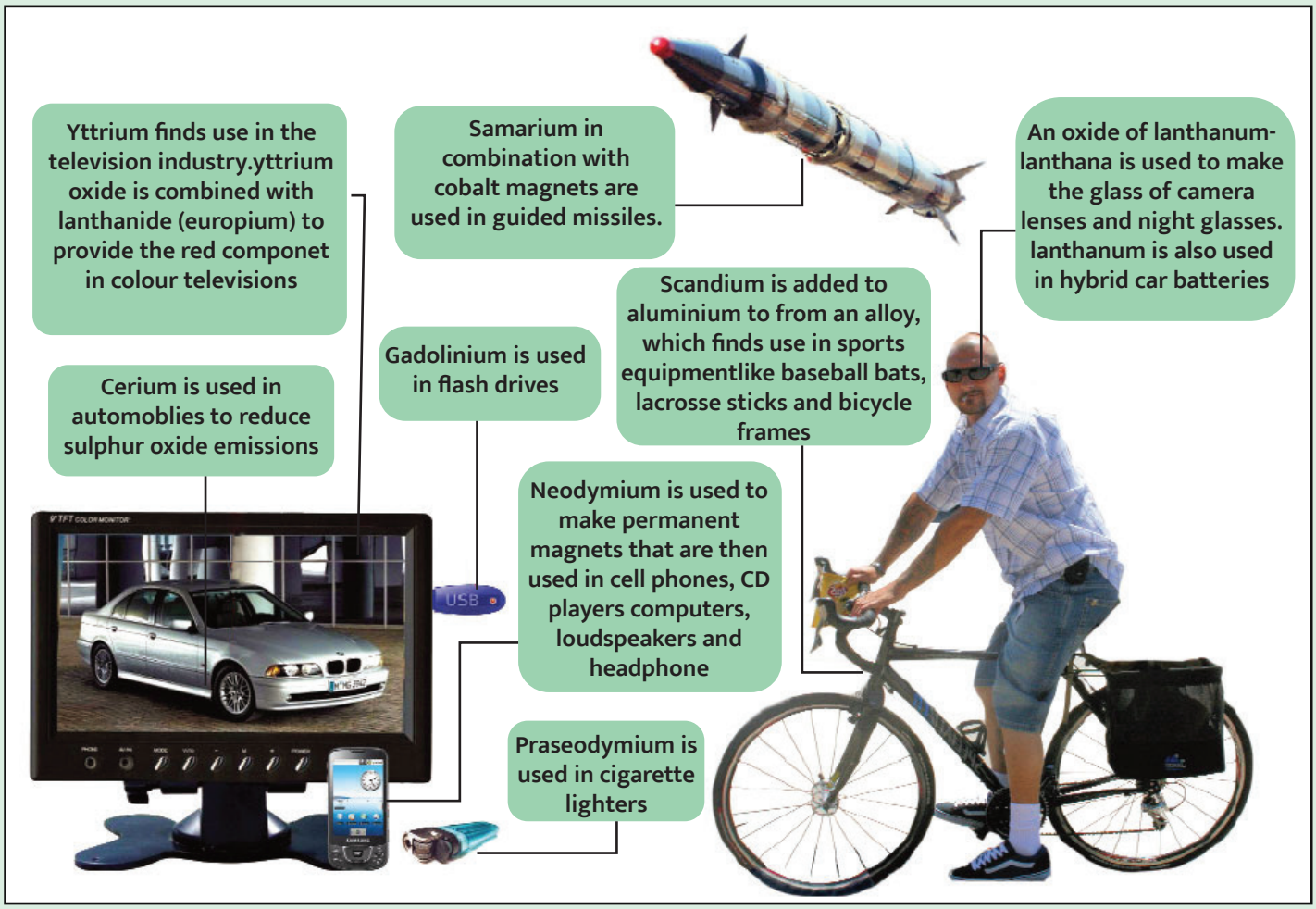
State	Monazite (Million Tonnes)
Odisha	2.41
Andhra Pradesh	3.72
Tamil Nadu	2.46
Kerala	1.90
West Bengal	1.22
Jharkhand	0.22
Total	11.93

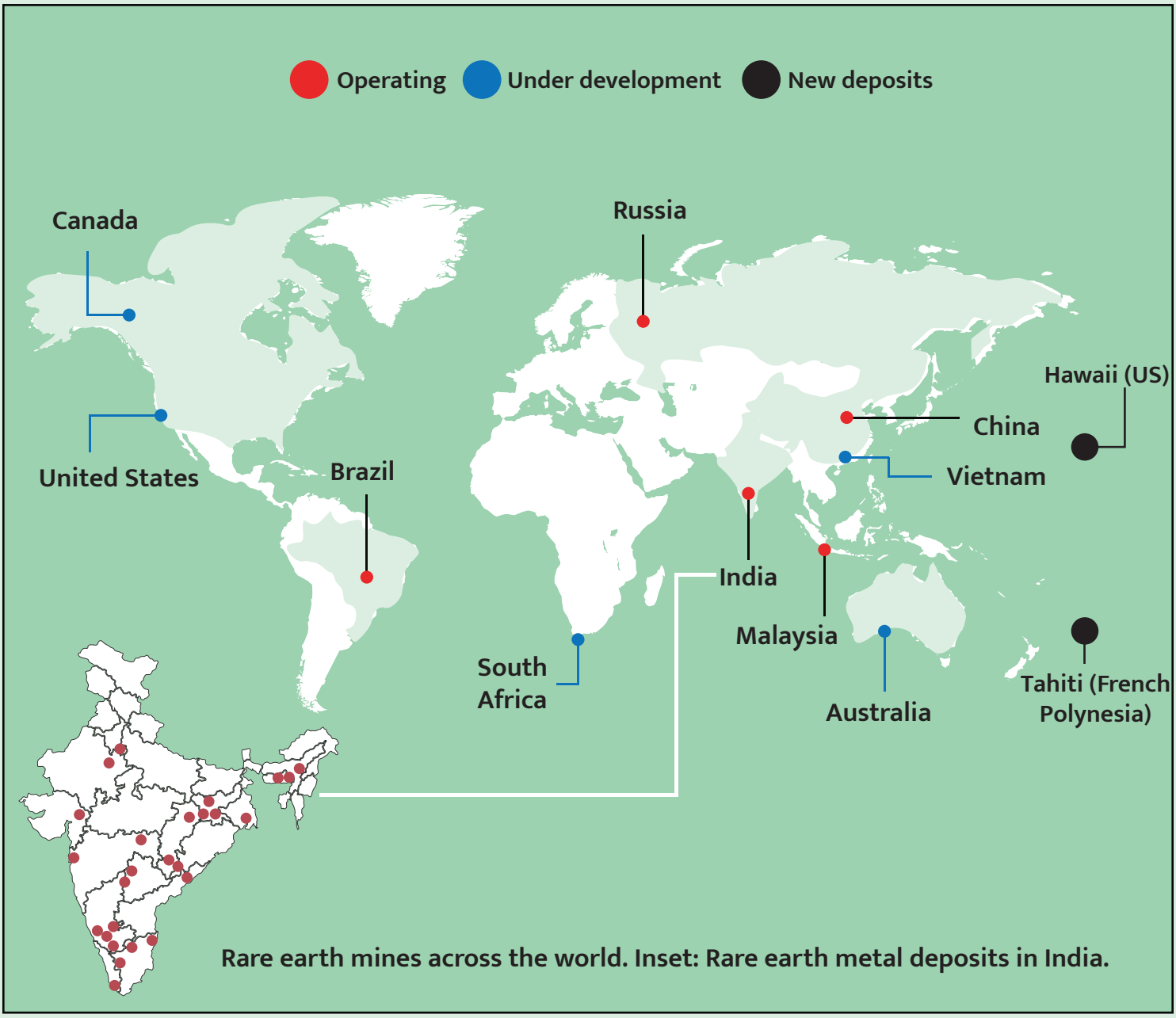
Rare Earth:

Rare earth Minerals

- Rare earth elements, also called rare earth metals, are a group of 17 chemical elements, They have simllar properties and also knows as " rare earth oxides".
- They have similar chemical properties. The largest subgroup within it are the 15 lanthanides. The two other elements are scandium and yttrium.
- Based on quantity, the lanthanides cerium, lanthanum and neodymium are the most produced rare earths elements.
- Usage: Rare earth elements are crucial for an number of key technologies such as medical technology and energy technology. They are used, among many other things, for lasers, battery electrodes, magnets, MRI contrast agents, catalysts, alloys etc.

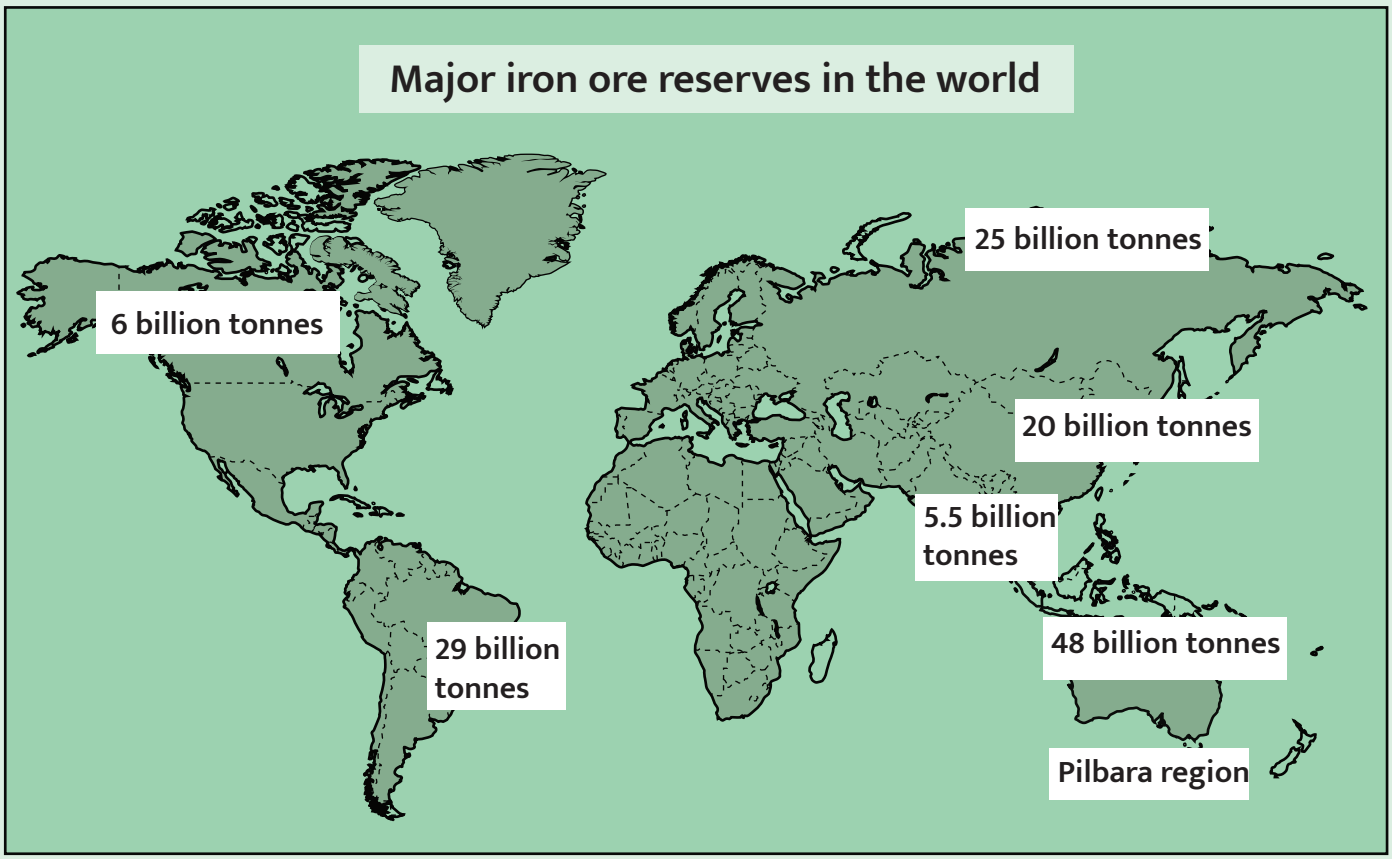
Where are the rare earths used





Rare earth mines across the world. Inset: Rare earth metal deposits in India.

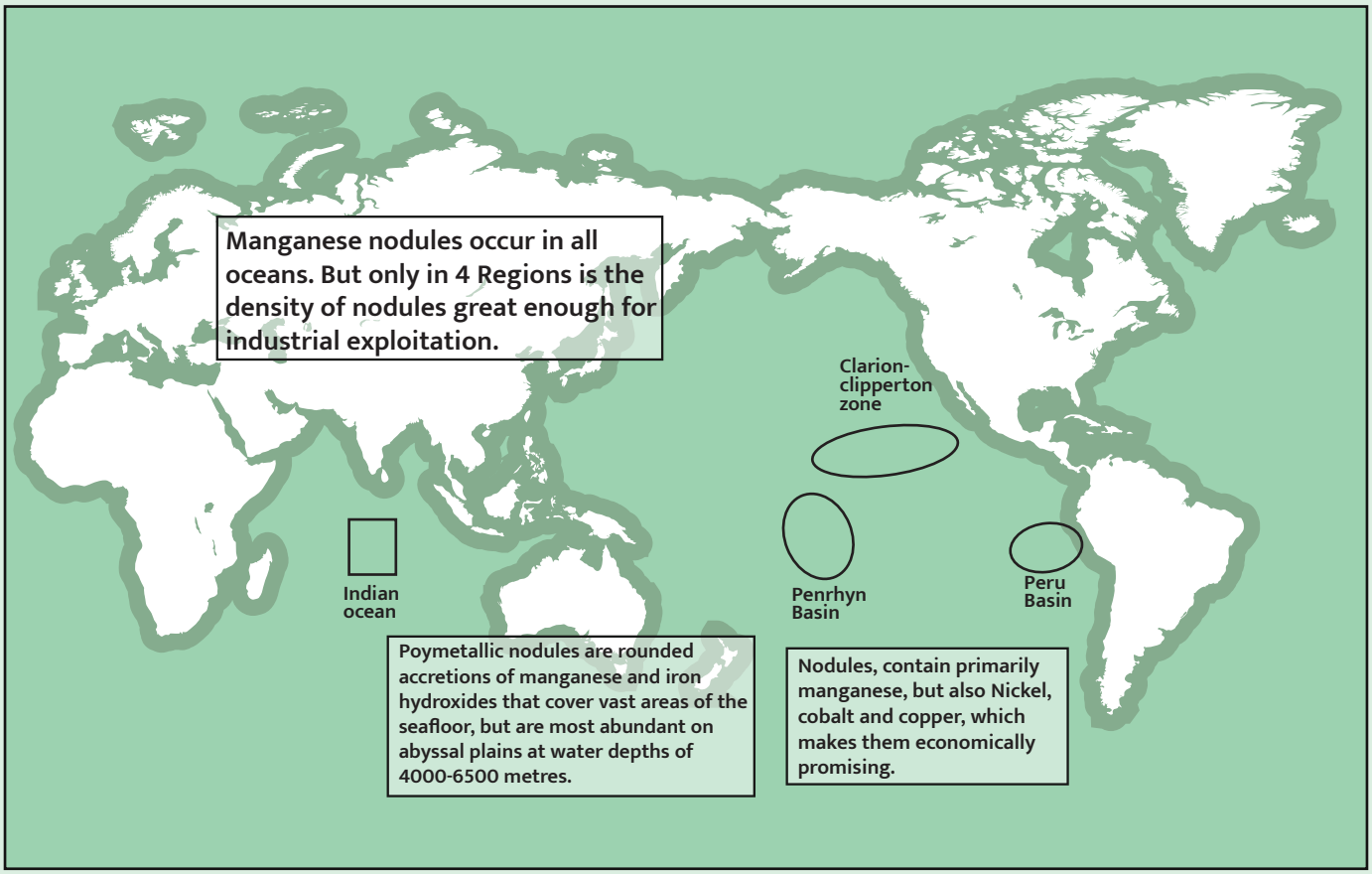
Iron Ore: World distribution.



Major iron compounds

Name	Formula	% Fe
Hematite	Fe_2O_3	69.9
Magnetite	Fe_3O_4	74.2
Geothite/ Limonite	$HFeO_2$	~63
Siderite	$FeCO_3$	48.2
Chamosite	$(Mg.Fe.Ai)_6(SI,AI)_{414}(OH)_8$	29.61
Pyrite	FeS	46.6
ILmenite	$FeTiO_3$	36.81

Mportant Mineral Distribution in India: Iron ore, Bauxite, Manganese, Mica.



Marine resources	Producing areas
Salt Production	Coastal areas of Gujarat, Tamil Nadu, and Inland production like in the region of Rajasthan.
Petroleum and natural gas	Discussed above in detail.
Fisheries	Almost all the coastal region.
Tidal energy	Gulf of Khambhat and also in Durgaduani creek.
Offshore wind energy	Potential of 70,000 MW along Gujarat, TN coasts.